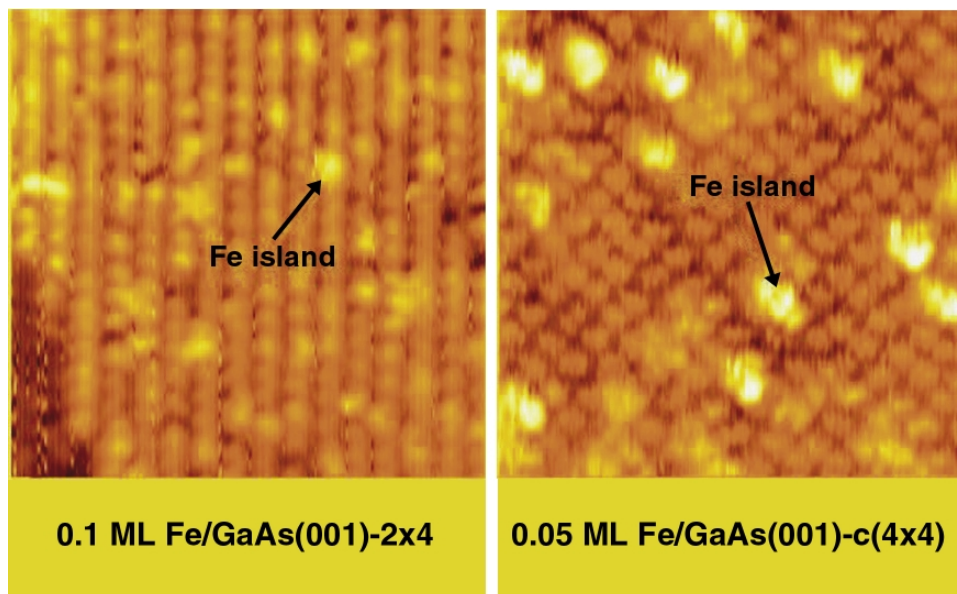


EPITAXIAL GROWTH CENTER



The birth of an interface: Fe on GaAs (001) 2x4 and c (4x4)

Technical advances in microelectronic and magnetoelectronic devices depend upon the controlled growth of materials at the atomic level. One effort in the Naval Research Laboratory Epitaxial Growth Center (Epi-Center) Facility focuses on the molecular beam epitaxial growth of ferromagnetic materials on semiconductor substrates, with the objective of using the *spin* of the electron (or hole) as a new degree of freedom to develop new properties and functionality.

The accompanying figure shows two Scanning Tunneling Microscope images that reveal the earliest stages of interface formation for a ferromagnetic film of **Fe** on the surface of **GaAs** (001). In each image, the bright yellow features are 6-10 atom islands of **Fe** which have nucleated on the **GaAs** (001) surface, and the darker orange features are bonded pairs of **As** atoms, called dimers, which terminate the **GaAs** surface. The two images differ in the initial arrangement of these **As** dimers on the as-grown **GaAs** (001) surface, which is selected by the growth conditions. The images reveal preferential **Fe** adsorption and island nucleation on **As**-dimer sites, and that the initial **GaAs** surface reconstruction controls the size and distribution of these islands.

These and other complementary data provide a detailed picture of the birth of an interface. This atomic scale information is necessary in interpreting the electronic and magnetic behavior of such heterostructures, and provides valuable input for theoretical calculations to promote fundamental understanding and predictive capabilities of material properties.

Point of Contact
Naval Research Laboratory
4555 Overlook Avenue, SW • Washington, DC 20375-5320

Berry Jonker • Materials Science and Technology Division
(202) 404-8015
jonker@nrl.navy.mil